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# Memorandum

Date: November 19, 2007

To: Tim Drexler/USEPA

From: Lisa JN Bradley

Subject: Responses to Remaining GeoHydro Comments Dated 9-21-07

Distribution: Pines Respondents

The following are responses to the GeoHydro comments dated September 21, 2007 concerning Larry Jensen's Radiological Data Review of ENSR's Draft *Evaluation of Polycyclic Aromatic Hydrocarbon, Polychlorinated/Dibenzodioxin/Polychlorinated Dibenzofuran, and Radionuclide Data from Yard 520* (Draft Yard 520 Evaluation report) provided to the Respondents by Tim Drexler/USEPA. USEPA asked for responses for two specific comments, which have been provided under separate cover; the responses contained herein address the remaining comments.

**Background Measurements** - Background data should have been taken from additional samples in the vicinity of Yard 520. The fundamental strategy for background samples is to select collection sites where the soil is as nearly like the soil of concern but assuredly without any contamination. Use of a national average background is inappropriate because local backgrounds can vary higher or lower. Inappropriate backgrounds can lead to either false positive or false negative conclusions.
That said, data in Table 6 under Background is reasonable for common soils and rocks.

> **Response:** Per USEPA, background for total radium can be taken as 2 pCi/g.

**Section 4.1.1 Background Evaluation** – The closing statement "…radionuclide concentrations present in CCBs collected from Yard 520 are generally within the range of background levels present in the environment" is not supported by the data in Table 4 and Table 5. This data was combined in the attached Table 1 where it can be seen that GP004-GP013 data (Table 4) has a range of about 2-7 times background (Table 5).

> **Response:** Table 1 in the comments only presents the mean background concentrations that were presented in the DraftYard 520 Data Evaluation Report's Table 5. It is not appropriate to compare site data to average background concentrations. As noted by the commenter above, background concentrations vary. Many background results are well above the average background concentration; but by the nature of an "average," approximately 50% of results will be greater than the average. Thus, the Draft Yard 520 Data Evaluation Report compared the site data to both the average and the range of background concentrations. As noted in the report, the 95% upper confidence limit (UCL) on the arithmetic mean concentration of the radionuclides detected in the Yard 520 samples were all within the range of background concentrations with the exception of U-234, which was only slightly above, and U-238.

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The commenter's Table 1 is also misleading in that it does not identify the results that were not detected (which are identified on the Draft Yard 520 Data Evaluation Report Table 1 with a U qualifier). This omission gives the wrong impression that all radionuclides were detected in all samples, which is not the case (for example, compare the Lead-210 results between the two tables).

**Section 4.1.2 Human Health Risk Screen Results –** USEPA Region 5 has done risk assessments for radionuclides. These have been done by multiplying USEPA risk-concentration factors for individual radionuclides (from Federal Radiation Guidance documents) times the measured concentration (less background), adding all risks, and comparing these to the Superfund (National Contingency Plan) risk range of 10-6 to 10-4. Risk found this way is excess risk, which is the proper focus for risk decisions. That process should be applied to this data set. In this way, there will be no need to convert risk to annual dose for comparison to the 15 millirem/year dose guideline. Risks should not be judged for individual radionuclides but by the summed risk for all radionuclides present. Also, for cleanups, USEPA Region 5 has largely relied upon the total radium standards in Title 40, Part 192 of the Code of Federal Regulations where 5 pCi/gplus background is used as the cleanup criterion for successive 15 centimeter depths below ground. Total radium is defined as the concentration for radium-226 plus the concentration for radium-228. From Table 1 the total radium background is 1pCi/g + 0.87pCi/g, respectively. Added to 5 pCi/g, this would be a cleanup guideline of 6.87 pCi/g for this site. In Table 1, sites GP007 and GP009 exceed this criterion. An actual cleanup level for this site cannot be determined until local background levels far at least radium-226 and radium-228 are measured.

**Response:** The radionuclide data was evaluated in the Draft Yard 520 Data Evaluation Report in the context of both risk and dose. To expand on the risk approach, Table 5 from the Draft Yard 520 Data Evaluation Report has been modified to include cumulative risk and is presented here as Table A. A cumulative risk screen based on the 95% UCL concentration for each radionuclide as well as the maximum detected concentration for each is presented. As can be seen, the calculated total risk for each evaluation (95% UCL and maximum) is well within the USEPA target risk range of $10^{-6}$ to $10^{-4}$. We acknowledge that USEPA Region 5 has largely relied upon the total radium standards in Title 40, Part 192 of the Code of Federal Regulations to calculate cleanup guidelines.

As noted in the response above, the background values provided in the commenter's Table 1 are mean values only, which are not representative of the range of background. It is also not appropriate to compare a background level on a sample by sample basis. The data as a whole should be compared to background, which was done in the DraftYard 520 Data Evaluation Report by comparing the 95% UCL of the data to the background range.

**Section 4.2 Literature Review** - Data presented in this report does not support the assertion that radioactivity in coal fly ash is comparable to radioactivity in background soils and rocks. Background levels for the primary radionuclides (those in the U-238 and Th-232 decay series) are about 1 pCi/g (Table 5) while measured levels in the GP004 – GP013 data (Table 4) are about 2 – 7 times this. If this GP data is considered to be from coal combustion products than there is a definite elevation over background as shown in the attached Table 1.

**Response:** Please see the response to the comment on Section 4.1.1, above.

**TABLE A**
**COMPARISON OF RADIONUCLIDE UCLs TO**
**BACKGROUND AND HUMAN HEALTH SCREENING VALUES, AND CUMULATIVE RISK SCREEN RESULTS**
**YARD 520 VALIDATED DATA**

| | | Summary Statistics | | | | | Background (b) | | Human Health | | Human Health Cumulative Screen - | Human Health Cumulative Screen - |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Radionuclide | Units | FOD | Minimum Detect | Maximum Detect | Mean | 95 UCL (a) | Mean | Range | Residential PRG | | 95% UCL (e) | Max (f) |
| LEAD-210 | pci/g | 6 : 10 : 10 | 2.27 | 6.81 | 2.94 | 4.11 | 1 | 0.23 - 4.2 | 0.33 | (c) | 1.3E-05 | 2.1E-05 |
| POLONIUM-210 | pci/g | 6 : 10 : 10 | 2.27 | 6.81 | 2.94 | 4.11 | -- | -- | 37.90 | (c) | 1.1E-07 | 1.8E-07 |
| RADIUM-226 | pci/g | 10 : 10 : 10 | 1.70 | 4.63 | 3.17 | 3.68 | 1 | 0.23 - 4.2 | 0.19 | (c) | 1.9E-05 | 2.4E-05 |
| RADIUM-228 | pci/g | 10 : 10 : 10 | 1.41 | 3.00 | 2.32 | 2.63 | 0.87 | 0.1 - 3.4 | 0.26 | (c) | 1.0E-05 | 1.2E-05 |
| THORIUM-228 | pci/g | 10 : 10 : 10 | 1.56 | 3.21 | 2.40 | 2.72 | 0.87 | 0.1 - 3.4 | 24.20 | (c) | 1.1E-07 | 1.3E-07 |
| THORIUM-230 | pci/g | 10 : 10 : 10 | 1.70 | 4.63 | 3.17 | 3.68 | 0.96 | 0.12 - 3.8 | 3.49 | (c) | 1.1E-06 | 1.3E-06 |
| THORIUM-232 | pci/g | 10 : 10 : 10 | 1.53 | 3.14 | 2.35 | 2.66 | 0.87 | 0.10 - 3.4 | 3.10 | (c) | 8.6E-07 | 1.0E-06 |
| URANIUM-234 | pci/g | 10 : 10 : 10 | 2.06 | 5.38 | 3.60 | 4.18 | 0.96 | 0.12 - 3.8 | 4.01 | (c) | 1.0E-06 | 1.3E-06 |
| URANIUM-235 | pci/g | 9 : 10 : 10 | 0.18 | 0.35 | 0.23 | 0.29 | 0.007 | 0.01 - 0.03 | 0.21 | (c) | 1.4E-06 | 1.7E-06 |
| URANIUM-238 | pci/g | 10 : 10 : 10 | 2.30 | 4.77 | 3.24 | 3.75 | 0.96 | 0.12 - 3.8 | 4.46 | (c) | 8.4E-07 | 1.1E-06 |
| TOTAL URANIUM | mg/kg | 10 : 10 : 10 | 6.14 | 14.1 | 10.57 | 12.2 | 2.1 | 0.29-11 | 16 | (d) | NA | NA |
| URANIUM-235 | mg/kg | 10 : 10 : 10 | 0.04 | 0.1 | 0.08 | 0.09 | 2.1 | 0.29-11 | 16 | (d) | NA | NA |
| URANIUM-238 | mg/kg | 10 : 10 : 10 | 6.09 | 14 | 10.49 | 12.1 | 2.1 | 0.29-11 | 16 | (d) | NA | NA |
| | | | | | | | | | | **Total** | **4.7E-05** | **6.3E-05** |

Notes
-- - Not Available.
bkg - background
FOD - Frequency of Detection - Number of detected samples: Number of samples used to calculate statistics: Total number of samples.
NA - Not Applicable.
UCL - Upper confidence limit.
(a) Calculated using ProUCL software. Data distribution for all radionuclides is normal, and UCL was calculated using Student's t.
(b) Background (pci/g) values are from USEPA Technical Support Document for the Development of Radionuclide Cleanup Levels for Soil (USEPA, 1994).
Background (mg/kg) values from Element Concentrations in Soils and Other Surfical Materials of the Conterminous United States. USGS Professional Paper 1270. Shacklette and Boerngen.1984.
(c) USEPA, 2004b. Radionuclide Toxicity and Preliminary Remediation Goals (PRGs) for Superfund. http://epa-prgs.ornl.gov/radionuclides/download.shtml. August 4, 2004.
(d) USEPA, 2004a. Preliminary Remediation Goals (PRGs). Value for residential soil. October 1, 2004. http://www.epa.gov/region09/waste/sfund/prg/index.html
(e) Values presented = [(95% UCL / Residential PRG) x 1E-06]; where 1E-06 is the target risk level upon which the residential PRGs are based.
(f) Values presented = [(Maximum detect / Residential PRG) x 1E-06]; where 1E-06 is the target risk level upon which the residential PRGs are based.